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It need hardly be pointed out that the angles α and β are not identical; and that the use of the factor 0·01652 with the angle α or the factor 0·01660 with the angle β will lead to sensibly erroneous values in the solar parallax.

The coefficients α or β will not however be obtained with accuracy from observations extending over periods of only two or three lunations, unless the periodical inequalities are accurately computed for the times of observation. The use of tabular places of the Sun, computed for intervals of a few days and then interpolated for the time of observation, will not in such cases be sufficient to secure accuracy.

The Secular Perturbations of the Earth arising from the Action of Venus. By R. T. A. Innes.

Although the eccentricities of the Earth and *Venus* are very small, the perturbing function is but slowly convergent on account of the high ratio of their mean distances.

Thus if the secular portion of the perturbing function be represented by

$$M\, e^{h} e'^{h} n^{f} \cos A,$$

as in Le Verrier (*Annales*, tome ii. p. 89), the largest coefficient M is in the case of

Second power = 3·2
Fourth power = 96·9 Le Verrier
Sixth power = 4710·0

I therefore undertook the computation of the secular terms by Gauss's method, as laid down by Professor Hill. The elements used are found in Hill's "Jupiter and Saturn." The mass of *Venus* is assumed $\frac{1}{408134}$, and I get the following results. For comparison I add the figures found by Le Verrier and Hill by algebraical expansion, reducing all results to the above mass.*

		Le V.	Hill.
	″	″	″
$\frac{de}{dt}$ =	+ 0·013156	+ 0·013440	
$e\frac{d\varpi}{dt}$ =	+ 0·057915	+ 0·057963	
$\frac{dp}{dt}$ =	+ 0·074459	+ 0·074504	+ 0·074433
$\frac{dq}{dt}$ =	− 0·284623	− 0·284538	− 0·284528
$\frac{dl}{dt}$ =	+ 11·232490	+ 11·229806	

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So that my computation may be verified or corrected, I give the most important figures involved:—

$$K = 330^\circ\ 56'\ 48''\!\cdot\!79 \qquad \log k = 9\cdot9994999$$

$$K_1 = 330\ \ 51\ \ \ 5\cdot11 \qquad \log k_1 = 9\cdot9997387$$

Dividing the circumference into 12 parts, the sums of functions for 0°, 60°, 120°, 180°, 240°, 300°, and 30°, 90°, 150°, 210°, 270°, 330°, are equal to each other, and for A, B, and $\frac{r^2}{a^2}$, they are as follows:—

$$\frac{r^2}{a^2} = 6 + 3e^2 \qquad \frac{A}{a^2} = 6 + 3e^2 + 6\left[\left(\frac{a_1}{a}\right)^2 - 2k\left(\frac{a_1}{a}\right)ee_1 \cos K\right]$$

$$\frac{B \cos \epsilon}{a^2} = 6\left[\left(\frac{a_1}{a}\right)^2 e_1 - ke\frac{a_1}{a} \cos K\right] \qquad \frac{B \sin \epsilon}{a^2} = -6\left[k_1\left(\frac{a_1}{a}\right) \cos \phi_1 e \sin K_1\right]$$

These tests were satisfied.

From a manuscript table I took the values of

$$M = \frac{\sin\left(60^\circ - \frac{\theta}{3}\right) - v_1}{\frac{3}{2}\sqrt[4]{12}} \quad \text{and } N = \frac{\frac{1}{2} + m^2 n^2 - v_1 \sin \theta}{\sin\left(60^\circ - \frac{\theta}{3}\right) - v_1}$$

To make these equal to Hill's functions, $\chi(r)$ and $\psi(r)$, it is necessary to multiply each by

$$\left[\frac{\cos\left(60 - \frac{\theta}{3}\right)}{\cos \theta}\right]^2$$

and N by M in addition. Instead of Hill's F, I computed Fq. In F_3 and J_3, I removed the common factor sin I, and in

$$\frac{a}{r} R \text{ \&c.}$$

the common factor

$$\left(\frac{a_1}{a}\right)^2 \cos^2 \phi_1$$

to the end of the calculation, so that I could write

$$\frac{a}{r} R_0 = \left(\frac{r}{a}\right)\left(\frac{q}{a^2}\right)^{-\frac{7}{2}} M\left[\frac{\cos\left(60 - \frac{\theta}{3}\right)}{\cos \theta}\right]^2 \{F_1 + J_1(p + qN)\}.$$

These changes are very simple, thus:—

$$\left[\frac{dp}{dt}\right]_{00} = \frac{m_1 n}{1 + m}\left(\frac{a_1}{a}\right)^2 \cos^2 \phi_1 \sin I\ [(\tfrac{1}{2}\,C_1^{(c)} - \sin \phi\ C_2^{(c)}) \sec \phi \sin \varpi$$

$$+ \tfrac{1}{2}\,C_1^{(s)} \cos \varpi].$$

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The portion of the table used for *Venus* and the Earth to find M and N is as follows :—

θ	Log M	θ	Log N
°		°	
1	9·5237699	1	0·1005869
2	9·5229823	2	0·0995895
3	9·5221837	3	0·0985821
4	9 5213742	4	0·0975647
5	9·5205536	5	0·0965374
6	9·5197219	6	0·0954999
7	9·5188789	7	0·0944526
8	9·5180245	8	0·0933955

I then have

	p		q^2	
1	0·4994744	0·5013630	0·0795055	0·0807033
2	0·5049397	0·5092804	826279	846595
3	0·5132391	0·5157380	863402	874101
4	0·5160732	0·5141376	876857	870065
5	0·5104671	0·5060796	853658	830996
6	0·5021677	0·4997626	809004	795465
S	3·0463612	3·0463612	0·5024255	0·5024255

	r		θ	
			° ′ ″	° ′ ″
1	0·0027381	0·0023201	+7 0 56·27	5 48 28·91
2	17893	13770	4 19 13·91	3 12 16·27
3	11341	9732	2 33 43·22	2 9 29·48
4	8465	8529	1 52 5·60	1 54 16·48
5	11449	17300	2 37 51·43	4 8 28·74
6	23844	27841	5 56 51·88	7 7 42·62
S	0·0100373	0·0100373	24 20 42·31	24 20 42·50

	F_1		F_2	
1	0 3248737	0·3261975	+0·0023649	−0·0001134
2	0·3293982	0·3339299	−0·0025722	−0·0043526
3	0·3384543	0·3413239	−0·0049775	−0·0042795
4	0·3414583	0·3389450	−0·0024456	+0·0000327
5	0·3348929	0·3306994	+0·0024915	+0·0042719
6	0·3273643	0·3253460	+0·0048968	+0·0041988
S	1·9964417	1·9964417	−0·0002421	−0·0002421

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	F_3		Log J_1	
1	+0·0021106	−0·0000634	n9·9590356	n9·9632968
2	−0·0001842	+0·0019107	n9·9702253	n9·9775761
3	+0·0041615	+0·0043359	n9·9836640	n9·9874669
4	+0·0022571	−0·0000193	n9·9883095	n9·9857584
5	−0·0002543	+0·0017453	n9·9799346	n9·9719857
6	+0·00139449	+0·0041263	n9·9641916	n9·9592765
S	−0·0120356	+0·0120355	9·8453606	9·8453604

	J_2		J_3	
1	−0·00585505	−0·00140226	+0·40785020	+0·80341952
2	+0·00468370	+0·00971660	+0·97976102	+0·88962359
3	+0·01115191	+0·00845479	+0·55715872	+0·07145088
4	+0·00332326	−0·00173361	−0·43735442	−0·83292266
5	−0·00513377	−0·00687857	−1·00926200	−0·91912349
6	−0·00770880	−0·00769584	−0·58665970	−0·10095402
S	+0·00046125	+0·00046111	−0·08850618	−0·08850618

	Log $\{p \times q N\}$		Log $\left(\frac{r}{a}\right)\left(\frac{q}{a^2}\right)^{-\frac{7}{2}} M\left(\frac{\cos\left(60-\frac{\theta}{3}\right)}{\cos\theta}\right)^2$	
1	9·9293839	9·9322094	0·8989321	0·8778041
2	9·9367767	9·9416173	0·8496439	0·8253422
3	9·9456301	9·9481456	0·8086417	0·7985623
4	9·9487182	9·9470473	0·7947352	0·7999840
5	9·9432020	9·9379393	0·8178429	0·8474369
6	9·9327766	9·9295283	0·8798797	0·9005482
S	9·6364875	9·6364872	5·0496755	5·0496777

	$\frac{a}{r}R_0$		$\frac{a}{r}S_0$	
1	−3·5542377	−3·4715104	−0·0206925	−0·0099099
2	−3·3800798	−3·3195412	+0·0104478	+0·0277033
3	−3·2909303	−3·2757000	+0·0312943	+0·0202729
4	−3·2636662	−3·2664060	+0·0031635	−0·0094760
5	−3·3061634	−3·3921547	−0·0132332	−0·0118988
6	−3·4993960	−3·5691123	−0·0129415	−0·0186450
S	−20·2944734	−20·2944246	−0·0019616	−0·0019535

	$\frac{a}{r}W_0$	
1	+2·7634580	+5·1869928
2	+5·9902685	+5·2147250
3	+3·1908882	+0·4260306
4	−2·4085589	−4·6520828
5	−5·8233581	−5·5949679
6	−3·7811149	−0·6498359
S	−0·0684172	−0·0691382

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The discordance in

$$\frac{a}{r}\mathrm{W}_0$$

is large, but I cannot account for it. Lastly

$$\begin{array}{llll}
\mathrm{A}_0^{(c)} = & -3{\cdot}3824082 & \mathrm{B}_0^{(c)} = & -0{\cdot}0003263 \\
\frac{1}{2}\mathrm{A}_1^{(c)} = & -0{\cdot}0719575 & \frac{1}{2}\mathrm{B}_1^{(c)} = & -0{\cdot}0057844 \\
\frac{1}{2}\mathrm{A}_1^{(s)} = & +0{\cdot}0194409 & \frac{1}{2}\mathrm{B}_1^{(s)} = & +0{\cdot}0098052 \\
\frac{1}{2}\mathrm{A}_2^{(c)} = & -0{\cdot}0132740 & \frac{1}{2}\mathrm{B}_2^{(c)} = & -0{\cdot}0041664 \\
 & & \frac{1}{2}\mathrm{B}_2^{(s)} = & -0{\cdot}0030421
\end{array}$$

$$\mathrm{C}_0^{(c)} = -0{\cdot}0114629$$

$$\tfrac{1}{2}\mathrm{C}_1^{(c)} = +1{\cdot}2651658$$

$$\tfrac{1}{2}\mathrm{C}_1^{(s)} = +2{\cdot}7113348$$

S and S_1 for $\frac{1}{2}\mathrm{C}_1^{(c)}$ are respectively

$$+7{\cdot}5928286 \text{ and } +7{\cdot}5891614,$$

and for $\frac{1}{2}\mathrm{C}_1^{(s)}$

$$+16{\cdot}268854 \text{ and } +16{\cdot}2671640.$$

The equation

$$\sin\phi\,\tfrac{1}{2}\mathrm{A}_1^{(s)} + \cos\phi\,\mathrm{B}_0^{(c)} = 0$$

I find equal to

$$-0{\cdot}00000016.$$

The epoch is 1850·0

Sydney, N.S.W.:
1892 *November* 4.

Photograph of the Cluster M 34 *Persei.*

By Isaac Roberts, D.Sc., F.R.S.

The photograph of the cluster M 34 *Persei* R.A. $2^{h}\ 35^{m}$ Decl. north 42° 20′ was taken on 1892 December 26, with an exposure of the plate during sixty minutes. It is No. 584 in the *General Catalogue*, and is described by Sir J. Herschel as bright, very large, little compressed, scattered stars, 9th mag.

The Earl of Rosse, in his *Observations of Nebulæ and Clusters of Stars*, p. 31, describes the cluster as large, bright, scattered cluster. An isosceles triangle of stars on the north side points south to a red star which has a small companion *s. p.*

The photograph confirms the general descriptions, and presents to the eye the component stars in the cluster in their true relative positions and magnitudes for future reference. Several of the stars in and around the cluster have faint stars like